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ABSTRACT

This paper extends the factor analytic research of C. W. Swartz and others (1990) on the North Carolina Teaching Performance Appraisal Instrument (NCTPAI), which contains 28 teaching practices grouped into 5 functions (management of instructional time, management of student behavior, instructional presentation, instructional monitoring, and instructional feedback). Data were collected on 305 teachers in a large city/county school system, using full-time professional teacher observers/raters. The professionally trained observers/raters rated each of the 28 practices on a 6-point scale, visited the teachers' classrooms, and made extensive notes relating to the 28 practices. One item was observed in less than half of the classrooms and was deleted, leaving a pool of 27 items. After deleting cases with missing values on the remaining 27 items, the data on 247 teachers were used. A confirmatory factor analysis, using the two factor (instructional presentation and management of student behavior) oblique solution of Swartz and others, was completed. Results were compared to those of the earlier study. Additional exploratory factor analyses were conducted to find a more appropriate model. The two factor oblique solution did not provide an adequate fit for the data. Analyses of the chi-squared test for the model and the fit indices suggest an inadequate model. The original factors of instructional monitoring and instructional feedback may be only one factor, with the other three original factors being maintained. Three tables are included. (RLC)

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The Factor Structure of the North Carolina Teaching Performance Appraisal Instrument: Another Look

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Introduction

Calls for reforms of education in the United States are coming from many sources, reflecting a growing concern about the quality of schooling in America. A variety of organizations (e.g., Presidential commissions, standards boards, private foundations, consortia, and individuals) have made recommendations dealing with such issues as structure and governance, curriculum, and teacher education. While each organization may stress different areas for reform, all agree that effective teaching is an essential component for effective schooling.

The continuing interest in the relationship between teaching behavior and student outcomes is clearly evident in the three Handbooks of Research on Teaching (e.g., Medley and Mitzel, 1963; Rosenshine and Furst, 1973; and Brophy and Good, 1983.) The process-product paradigm, which studies the relationships between specific teacher behaviors and student outcomes, is one approach to the study of teaching that has survived over a long period of time. One such program of research on the development of large-scale teaching performance assessment has been conducted at the University of North Carolina at Chapel Hill since 1983 by the Group for the Study of Effective Teaching. A synthesis of over 600 studies resulted in the identification of 28 teaching practices that met the following criteria: the teaching practice was one used by all teachers, regardless of grade level or subject area; the teaching practice was related to student outcomes; the effectiveness of the teaching practice related to student achievement was documented in more than one study; and the teaching practice could be learned by teachers-in-training. These 28 teaching practices were logically classified into five teaching functions (Management of Instructional Time, Management of Student Behavior, Instructional Presentation, Instructional

Monitoring, and Instructional Feedback.) The resulting instrument was called the North Carolina Teaching Performance Appraisal Instrument (NCTPAI.) A number of studies have been completed which have examined the reliability and validity of the NCTPAI as a large-scale teaching performance assessment instrument, including its relationship to student achievement. This study extends the factor analytic research on the NCTPAI.

North Carolina Teaching Performance Appraisal Instrument

The NCTPAI was pilot tested over a two year period from 1984 to 1986. Based on the results of these pilot tests, all school districts in North Carolina were required to use the instrument for teacher evaluation. The instrument has also been adopted or adapted by a number of school systems outside of North Carolina for large-scale teaching performance assessments. In its current form, the instrument contains 28 Teaching Practices.

The groupings of the 28 teaching practices into the five functions were based on a logical examination of item content. Observer/raters rate the teacher's performance on each of the teaching functions using a six point scale.Reliability estimates (g-coefficients) of the five subscales when using professional trained observer/raters have ranged from .77 to .91 when using two raters. Inter-rater agreement estimates using two raters have consistently been in the low .90s. Validity studies of the NCTPAI have presented mixed results. Several studies have shown subsets of the five functions, but not all, to be related to student achievement gains. One study found an improvement in ratings for beginning teachers after they were given feedback regarding performance, suggesting that the skills on the NCTPAI can be learned. Thus, the NCTPAI appears to hold some promise for the assessment of teaching.

Swartz, White, Stuck, and Patterson (1990) reported a factor analytic study of the NCTPAI to examine the empirical basis for grouping the 28 items into the five functions. Their study was described as an attempt to "provide clearer and more meaningful constructs to describe the performance of each teacher rated by this instrument (pp. 176-177.)" The results of that study suggested that a two-factor oblique solution was the most interpretable. The two factors were labeled as Instructional Presentation and Management of Student Behavior and were found to be moderately related (r = .59). That solution is described in Table 1 which also contains all of the NCTPAI practices.

The Present Study

To re-examine the factor structure of the NCTPAI, data were collected on a sample of 305 teachers using professionally trained observer/raters. A confirmatory factor analysis, using the Swartz et al. solution as a model, was completed and the results were compared to those of the earlier study. Additional exploratory factor analyses were conducted in an attempt to find a more appropriate model.

Data Source

Data were collected in the same school system used by Swartz et al. (1990). Observations were made on 305 teachers in a large city/county school district; teachers represented all grade levels (K-12) and all subjects taught in middle/secondary schools. Observations were made by the same full-time professional teacher observer/raters used by Swartz et al. (1990). The professional observer/raters had received extensive training in the use of the instrument. A modification of procedures was made in that observers rated each

of the 28 practices on a 6-point scale, rather than using observations of the items to rate the five functions on a 6-point scale. The observer/raters visited the teachers' classrooms and made extensive notes relating to the 28 practices. After leaving the classroom, ratings were made on each of the 28 items.

Analyses

The data base for the 305 teachers was examined prior to major analyses. One item (Provides feedback on Out of Class Work) was observed in less than half of the classrooms and was deleted from further analyses, leaving a pool of 27 items. Retaining all 28 items would have resulted in a sample of 134 teachers with complete sets of data. After deleting cases with missing values (not observed) on the remaining 27 items, a sample of 247 teachers remained. A covariance matrix was computed using the SPSS Reliability procedure and subsequently analyzed using EQS Version 3.0 (Bentler, 1989). The structural equations were specified in accord with the findings reported by Swartz et al. (1990).

Findings

The two factor oblique solution as reported by Swartz et al. (1990) did not provide an adequate fit for these data. Examinations of the chi-squared test for the model and the fit indices reported in EQS suggested an inadequate model ($X^2(323, N = 247) = 1457.48$, $p < .001$; NFI = .749, NNFI = .774, CFI = .792). Although not meeting standard criteria for an acceptable model, the two factor oblique model served as a starting point from which to complete analyses of alternative models based on exploratory factor analyses of the same data base using SPSS.

Returning to the original data base of 305 teachers, a correlation matrix of the 27 NCTPAI items was prepared and examined. The Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) was .9435, putting it in the "marvelous" range (Kaiser, 1974.) A preliminary principal components analysis of the matrix yielded four eigenvalues greater than one, accounting for 68.8% of the total variance. It was noted that Practice 1 had a final communality estimate of .38, with all others greater than .50. Based on these initial results, it was decided to examine solutions of two, three, four, and five common factors as Guertin, Guertin, and Ware (1981) noted that underrotation may distort the factor loadings when the common factor space is compressed. Both orthogonal and oblique rotations were examined, although it became clear very early that the factors were correlated. Thus, primary attention was given to the oblique solutions.

The two-factor oblique solution was quite similar to that reported by Swartz et al. (1990), one which was described above as inadequate. The three factor oblique solution resulted in three of the 27 practices failing to produce substantial loading on any factor. In the four factor oblique solution, only Practices 1 and 12 failed produce clear loadings. The five factor oblique rotation produced one factor with only one practice, and also yielded nine items with no clear loadings. Based on these results and the conceptual meaning of the solutions, it was decided to focus upon the four factor solution, deleting Practices 1 and 12.

A reexamination of the correlation matrix among the 25 remaining Practices resulted in a KMO of .9442, with four eigenvalues greater than one and accounting for 71.1% of the total variance. The reproduced correlation matrix in SPSS indicated only 13% of the residuals in excess of .05. The results of this exploratory factor analysis were used to complete an "exploratory" confirmatory factor analysis using EQS, in order to produce indices of fit. The results of

this analysis indicated a considerably better fit ($X^2(269, N = 247) = 985.37$, $p < .001$; NFI = .821, NNFI = .847, CFI = .863). A summary of the standardized solution is presented in Table 2, with the estimated intercorrelations among the factors presented in Table 3. Estimated reliabilities using Cronbach's alpha were derived with the SPSS Reliability procedure and are also reported in Table 3. While this model produced a fit less than the commonly acceptable standard (Bentler and Bonett, 1980), Bollen (1990) has suggested that consideration of other factors may lead to other cutoffs. In particular, he noted that small sample sizes may result in underestimates of the goodness of fit. In addition, one must consider the standards set by earlier work in the area. Nevertheless, we are somewhat encouraged by these results. The factors have been tentatively labeled as Instructional Presentation, Classroom Management, Time on Task, and Monitoring/Feedback; respectively.

These results are quite promising, being more consistent with the original five factors as conceptualized when the practices were selected for inclusion. It appears that the original factors of Instructional Monitoring and Instructional Feedback may be only one factor, with the other three original factors being maintained. Clearly, more work on the NCTPAI is warranted.

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Table 1

Teaching Practices Contained on
The North Carolina Teaching Performance Appraisal Instrument(NCTPAI)
and the Two Factor Solution Reported by Swartz et al.

Practice Number	Description of Practice	Swartz et al. Solution Factor1	Factor2
1	Material Ready	.47	
2	Class Started Quickly	.43	.36
3	Gets Students on Task	.38	.49
4	Maintains High Time on Task	.36	.46
5	Rules: Administrative and Organizational		.74
6	Rules: Verbal Participation		.83
7	Rules: Movement		.78
8	Frequently Surveys the Class Visually		.67
9	Stops Inappropriate Behavior Quickly		.85
10	Begins Lesson with Review	.58	
11	Introduces Lesson	.72	
12	Speaks Fluently-Precisely	.72	
13	Lesson Understandable to Students	.84	
14	Provides Relevant Examples	.86	
15	High Student Success Rates: Tasks	.84	
16	High Student Success Rates: Questions	.85	
17	Conducts Lesson at a Brisk Pace	.57	
18	Transitions Between & Within Lessons	.42	.51
19	Assignments Clear	.74	
20	Summarizes Main Points of Lesson	.74	
21	Maintains Student Work Deadlines & Standards	.62	
22	Checks Student Performance during Ind. Work	.64	
23	Assesses Performance of All Students	.81	
24	Questions Posed to Students One at a Time	.78	
25	Provides Feedback on In Class Student Work	.84	
26	Provides Feedback on Out of Class Work[1]		
27	Affirms Correct Answer Quickly	.76	
28	Provides Sustaining Feedback to Students	.64	

[1]Note: Practice 26 gave loadings less than .30 on both Factors

Table 2

Standardized Solution for EQS 3.0 for a Four Factor Oblique Solution: Teacher Practices and Loadings

Item	Teacher Practice	Factor1	Factor2	Factor3	Factor4
16	High Success Rate: Questions	.85			
15	High Success Rate: Tasks	.85			
17	Conducts Lessons at a Brisk Pace	.83			
13	Lesson Understandable	.82			
18	Transitions Between & Within	.80			
20	Summarizes Main Points of Lesson	.79			
19	Assignments Clear	.78			
14	Provides Relevant Examples	.78			
11	Introduces Lesson	.77			
4	High Time on Task	.75			
10	Begins Lesson with Review	.70			
9	Stops Inapprop. Behav. Quickly		.86		
8	Frequently Surveys Class Visually		.83		
6	Rules: Verbal Participation		.83		
7	Rules: Movement		.80		
5	Rules: Admin. and Organiz.		.78		
3	Gets Students on Task			.95	
2	Class Started Quickly			.85	
25	Feedback on In Class Performance				.86
23	Assesses Performance of All Students				.86
21	Maintains Deadlines and Standards				.86
28	Provides Sustaining Feedback to Students				.70
22	Checks Student Performance during Ind. Work				.66
24	Questions Posed to Students One at a Time				.62
27	Affirms Correct Answer Quickly				.61

Note: Factor1 - Instructional Presentation
Factor2 - Classroom Management
Factor3 - Time on Task
Factor3 - Monitoring/Feedback

Table 3

Factor Intercorrelation Matrix with Cronbach's alphas Reported as Estimates of Reliability

	Factor1	Factor2	Factor3	Factor4	: r_{kk}
Factor1	-	.72	.71	.85	: .95
Factor2		-	.60	.64	: .91
Factor3			-	.62	: .89
Factor4				-	: .89